VELLALAR COLLEGE FOR WOMEN (AUTONOMOUS)

"College with Potential for Excellence"

(Reaccredited with 'A' Grade by NAAC & Affiliated to Bharathiar University)

Erode-12

Department of Physics

M.Sc Physics

CBCS PATTERN

Course Contents

Scheme of Examinations and Credits

Question Paper Pattern

Syllabus

Submitted to the Board of Studies

16.04.2016

Vellalar College for Women (Autonomous) Erode-12

Master of Science in Physics

2016-2017 Onwards

Course Content and Scheme of Examination (CBCS Pattern)

Semester-I

Study component	Subject code	Title of the paper	Inst. Hrs./Week	Exam. Dur. Hrs.	Max. marks			Credits
					CIA	ESE	Total	
Core	16PHPC101	Classical Mechanics	5	3	25	75	100	4
	16PHPC102	Mathematical Physics-I	5	3	25	75	100	4
	16PHPC103	Analog and Digital Electronics	5	3	25	75	100	4
	16PHPC104	Quantum Mechanics-I	5	3	25	75	100	4
	16PHPCP01	Core Practical-I General Experiments	3	-	-	-	-	-
	16PHPCP02	Core Practical-II Electronics	4	-	-	-	-	-
Non-Major Elective			3	3	25	75	100	5

Semester-II

Study component	Subject code	Title of the paper	Inst. Hrs./Week	Exam. Dur. Hrs.	Max. marks			Credits
					CIA	ESE	Total	
Core	16PHPC205	Mathematical Physics-II	6	3	25	75	100	4
	16PHPC206	Advanced Computational Physics	6	3	25	75	100	4
	16PHPC207	Quantum Mechanics-II	6	3	25	75	100	4
	16PHPCP01	Core Practical-I General Experiments	4	4	40	60	100	4
	16PHPCP02	Core Practical-II Electronics	4	4	40	60	100	4
Skill Based Subject-I	13PHPS201	Advanced Multi Skill Paper	3	2	40	60*	100	5
		Library	1	-	-	-	-	-

Semester-III								
Study component	**Subject code**	**Title of the paper**	**Inst. Hrs./Week**	**Exam. Dur. Hrs.**	**Max. marks**			**Credits**
					CIA	**ESE**	**Total**	
Core	16PHPC308	Condensed Matter Physics	5	3	25	75	100	4
	16PHPC309	Electromagnetic Fields and Waves	5	3	25	75	100	4
	16PHPCP03	Core Practical-III Advanced Experiments	4	-	-	-	-	-
	16PHPCP04	Core Practical-IV Special Electronics	4	-	-	-	-	-
Elective-I	16PHPE301	Communication Electronics and Microprocessor	5	3	25	75	100	4
Skill Based Subject-II			3	3	25	75	100	5
Skill Based Subject-III			3	3	25	75	100	5
		Library	1	-	-	-	-	-
Semester-IV								
Study component	**Subject code**	**Title of the paper**	**Inst. Hrs./Week**	**Exam. Dur. Hrs.**	**Max. marks**			**Credits**
					CIA	**ESE**	**Total**	
Core	16PHPC410	Nuclear and Particle Physics	6	3	25	75	100	4
	16PHPC411	Molecular Spectroscopy	6	3	25	75	100	4
	16PHPCP03	Core Practical-III Advanced Experiments	4	6	40	60	100	4
	16PHPCP04	Core Practical-IV Special Electronics	4	6	40	60	100	4
Elective-II	16PHPE402	Thermodynamics and Statistical Mechanics	6	3	25	75	100	4
	09PHPC4PV	Project and Viva Voce	3	-	-	100	100	2
		Library	1	-	-	-	-	-
Total							2200	90

Skill Based Subjects		
Semester	**Subject Code**	**Name of the paper**
II	13PHPS201	Advanced Multi Skill Paper
III	11PHPS302	Nano Science and Technology (Cafeteria)
III	11PHPS303	Laser in Chemical and Biological Sciences (Cafeteria)
Non Major Elective		
Semester I	11PHPN101	Atmospheric Physics
Self-learning paper		
Paper-I	13PHPSL03	Oceanography

* - Online Examination

DEPARTMENT OF PHYSICS

Question Paper Pattern

CORE AND ELECTIVE PAPERS

Duration: 3.00 hrs **Marks: 75**

Section – A **(10 × 1 = 10 marks)**

Multiple Choice Questions - 10 (Two from each unit) (Q. No 1 – 10)

Section – B **(5 × 5 = 25 marks)**

Answer all the Questions (Either or pattern)

One Question from each unit (Q. No 11 – 15)

Section – C **(5 × 8 = 40 marks)**

Answer all the Questions (Either or pattern)

One Question from each unit (Q. No 16-20)

SKILL BASED SUBJECTS

Five Questions out of **Eight** **(5 ×15 = 75 marks)**

SELF LEARNING PAPERS AND NON MAJOR ELECTIVE

Five Questions out of **Eight** **(5 ×20 = 100 marks)**

CIA- MARK DISTRIBUTION

Theory

To conduct two test and average of two test	10 marks
Model exam	10 marks
Seminar / Assignment	5 marks
Total	**25 marks**

Practical Internal

2 tests	10 marks
Model	10 marks
Continuous Assessment	15 marks
Record	5 marks
Total	**40 marks**

Practical Examination

Experiment	50 marks
Record	10 marks
Total	**60 marks**

Project

Project CIA	40 Marks
Report /Thesis	40 Marks
Viva	20 Marks
Total	**100 marks**

QUESTION PAPER PATTERN FOR CORE PAPERS

SECTION A – Two multiple choice / Fill ups from each unit.

SECTION B – Two Short questions from each unit in either or pattern.

SECTION C – Two Long question from each unit in either or pattern.

SECTION A- Multiple choice questions / Fill ups : 10X1 =10 marks.

SECTION B – Short questions : 5X5= 25 marks

SECTION C – Long questions : 5X8= 40 marks

Internal assessment: 25 marks

Total Marks = External + Internal = 75+25 = 100 Marks.

QUESTION PAPER PATTERN FOR SKILL BASED SUBJECT AND NON-MAJOR ELECTIVE

Open Choice

Any five questions are to be answered from eight questions.

Each question carries fifteen marks (5X15 = 75 marks)

Total marks = 75

Questions must be from all units with not more than two questions from the same unit.

QUESTION PAPER PATTERN FOR CORE PAPERS

SECTION A- Two multiple choice / Fill ups from each unit.

SECTION B – Two Short question from each unit in either or pattern.

SECTION C – Two Long question from each unit in either or pattern.

SECTION A- Multiple choice questions / Fill ups : 10X1 =10 marks.

SECTION B – Short questions : 5X5= 25 marks

SECTION C – Long questions : 5X8= 40 marks

Internal assessment: 25 marks

Total Marks = External + Internal = 75+25 = 100 Marks.

QUESTION PAPER PATTERN FOR SKILL BASED SUBJECT AND NON-MAJOR ELECTIVE

Open Choice

Any five questions are to be answered from eight questions.

Each question carries fifteen marks (5X15 = 75 marks)

Total marks = 75

Questions must be from all units with not more than two questions from the same unit.

SEMESTER – I

CORE PAPER – I

CLASSICAL MECHANICS

Instructional Hrs. : 75 **Sub. Code : 16PHPC101**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : To provide depth of knowledge in classical mechanics and applications. To equip the students to face the national level physics examinations.

Unit – I **15 Hrs.**

Mechanics of Single and Systems of Particles

Newton's laws of motion - Mechanics of a particle - Equation of motion of a particle - Motion of a particle under constant force and alternating force - Mechanics of systems of particles - Angular momentum of the system - Potential and kinetic energies of the system - Motion in a central force field - Motion of two particles equivalent to single particle - Equation of motion of centre of mass with respect to centre of force - Motion in an inverse-square law force field - Classification of orbits

Unit – II **15 Hrs.**

Collisions of Particles and Motion of Rigid Body

Elastic and inelastic scattering - Laboratory and centre of mass systems - Relations between different quantities in the laboratory and centre of mass systems –Kinematics of elastic scattering in the laboratory system- Inelastic scattering in the laboratory frame – Motion of a rigid body -Euler's theorem - Angular momentum and kinetic energy - *Inertia tensor* - Euler's equation of motion – Torque Free Motion – Euler's angles.

Unit – III

Lagrangian and Hamiltonian Formulations **15 Hrs.**

Hamilton's variational principle - Lagrange's equations of motion –Conservation theorems and symmetry properties – Cyclic coordinates - Application of Lagrange's equation; Linear harmonic oscillator, particle moving under a central force, Atwood's machine - Hamilton's equations of motion - Application of Hamiltonian's equations of motion; Particle moving in an electromagnetic field - *Phase space* - Principle of least action

Unit – IV **15 Hrs.**

Canonical Transformations and Poisson Brackets

Canonical transformations – Generating function – Properties of canonical transformations – Poisson brackets – Properties of Poisson brackets – Constant of motion using Poisson brackets – Poisson brackets of canonical variables – Poisson's Theorem – Invariance of Poisson bracket under canonical transformation – Motion as successive canonical transformation (Infinitesimal generators) – Liouville's theorem - The Hamilton–Jacobi equation – *Action and angle variables*

Unit – V **15 Hrs.**

Small Oscillations

Small oscillations - *Stable and unstable equilibrium* - Lagrange's equation of motion for small oscillations - Normal coordinates and normal frequencies - Small oscillations of particles on string - Free vibrations of linear triatomic molecule – Two carts connected with three springs – Triple pendulum - Double pendulum

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **R. G. Takwale and P. S. Puranik**, *Introduction to Classical Mechanics*, Tata McGraw-Hill (2006), New Delhi
2. **Charles Poole and John Safko Herbert Goldstein,** *Classical Mechanics*, Pearson Education and Dorling Kindersley (2007), New Delhi
3. **Gupta, Kumar and Sharma**, *Classical Mechanics* Pragati Prakashan (2001), New Delhi
4. **J.C. Upadhyaya,** *Classical Mechanics*, Himalaya Publishing House (2005) India

REFERENCE BOOKS

1. **John R. Taylor,** *Classical Mechanics*, University Science books (2005), India
2. **R. Douglas Gregory,** *Classical Mechanics*, Cambridge University press, (2008) India

SEMESTER – I

CORE PAPER – II

MATHEMATICAL PHYSICS – I

Instructional Hrs. : 75 **Sub. Code : 16PHPC102**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : Mathematics is aptly called the language of physics. The paper provides the core concepts of mathematical physics. The syllabus is so framed that it fulfills the requirements of CSIR / GATE / NET Exams.

Unit-I **15 Hrs.**

Matrices and Determinants

Properties of matrix addition and multiplication – different type of matrices and their properties – Rank of a Matrix and some of its theorems – Solution to linear homogeneous and non homogeneous equations – Cramers rule – eigenvalues and eigenvectors of matrices – differentiation and integration of matrix.

Unit-II **15 Hrs.**

Solving of differential equations

Homogeneous linear equations of second order with constant coefficients and their solutions – ordinary second order differential with variable coefficients and their solution by power series and Frobenius methods – *extended power series method for indicial equations.*

Unit-III **15 Hrs.**

Special differential equations and their solutions

Legendre's differential equation: Legendre polynomials – *Generating functions* – Recurrence Formulae–Rodrigue's formula–orthogonality of Legendre's polynomial;Bessel's differential equation: Bessel's polynomial –generating functions– Recurrence Formulae–orthogonal properties of Bessel's polynomials– Hermite differential equation– Hermite polynomials – generating functions – recurrence relation.

Unit-IV **15 Hrs.**

Laplace Transforms

Laplace transforms: Linearity property, first and second translation property of LT – Derivatives of Laplace transforms – Laplace transform of integrals – Initial and Final value theorems; Methods for finding LT:direct and series expansion method, Method of differential equation; Inverse Laplace transforms: Linearity property, first and second translation property, *Convolution property* – Application of LT to differential equations and boundary value problems.

Unit-V **15 Hrs.**

Fourier series and integrals

Fourier series definition and expansion of a function x – Drichlet's conditions - Assumptions for the validity of Fourier's series expansion and its theorems – Complex representation of Fourier series – problems related to periodic functions – graphical representation of FS – Fourier integrals – *convergence of FS* – some applications of Fourier transforms.

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **B.D.Gupta**, *Mathematical Physics*, Vikas Publishing House Pvt ltd. 3rd Edition 2006
2. **Parthasarathy H**, *Topics in Mathematical Physics*, Ane Books Pvt. Ltd 2007
3. **G. Arfken,** *Mathematical methods for physics*, Elsevier 6th edition 2010
4. **Sathya Prakash,***Mathematical Physics* –S. Chand & Sons, New Delhi, 1985.

REFERENCE BOOKS

1. **Rajput,** *Mathematical Physics*, Pragati Prakasam, Meerut, 17th Edition 2004
2. **Erwin Kreyszig,** *Advanced Engineering mathematics*, Wiley Eastern Limited Publications 7th Edition 1993
3. **W.W.Bell,** *Special Function*, 1968

SEMESTER – I

CORE PAPER - III

ANOLOG AND DIGITAL ELECTRONICS

Instructional Hrs. : 75 **Sub. Code : 16PHPC103**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : The approach is to stress the fundamental concepts in the analysis and applications of analog and digital electronics.

Unit-I **15 Hrs.**

Semiconductor Devices

JFET- Structure and working - I -V Characteristics - CS amplifier design – MOSFET: Depletion and Enhancement type MOSFFT – Operation principle of UJT - UJT - Relaxation oscillator - SCR characteristics - application in power control- DIAC,TRIAC

Unit-II **15 Hrs.**

Operational Amplifier

Frequency Response of an Op-Amp – Parameters of an OP-Amp – Sign changer - Scale changer – *Adder* – Subtractor – Integrator - Differentiator – Phase shifter – Differential Amplifier –Voltage Regulator - Analog computer setup to solve Linear Simultaneous Equation – Differential equations in Physics – Logarithmic & Exponential Amplifier – Active filters.

Unit-III **15 Hrs.**

Digital Circuits and Devices

Binary Adders: Half Adder-Parallel Operation-Full Adder-MSI Adder-Serial Operation; Decoder/Demultiplexer: BCD to Decimal Decoder-4-to-16 line Demultiplexer; Data Selector/Multiplexer:16-to-1 *Multiplexer*; Encoder; – Edge triggered and Master slave flip flop – Synchronous, Asynchronous and Cascade counter - Shift registers: four types – Memories:- RAM, ROM, PROM, EPROM.

Unit-IV **15 Hrs.**

Signal Processing & Data acquisition

Wave Form Generators and wave shaping circuits – Sinusoidal oscillators – *Phase shift oscillators* – Comparators – Schmitt Trigger – Square wave & Triangular wave generators – IC 555 Timer and its application – Signal and Signal Processing – Analog

Multiplexer and Demultiplexer – Sample and Hold Systems – D/A Converters- A/D Converters.

Unit-V **15 Hrs.**

Microwave Oscillators: Microwaves Generation – *Multicavity Klystron* – Reflex Klystron – Magnetron – Traveling Wave Tubes (TWT) – Crossed field amplifier and Backward wave oscillator - Microwave Transistors – Gunn Diode

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1.**Floyd**, *Digital fundamentals*, Universal Book Stall, New Delhi, 2003.
2.**Jacob mill Mann, Arvin Grabel**, *Microelectronics*, Tata McGraw Hill, New Delhi, 2003.
3.**Mill Mann & Hal kais**, *Integrated Electronics*, Tata McGraw Hill, New Delhi, 2005.
4. **S. Chattopadhyay,** *Text Book of Electronics*, New Central Book Agency P.Ltd., Kolkata, 2006.
5. **A.P. Malvino and D.P. Leach**, *Digital Principles and Applications*, Tata McGraw-Hill, Publishing Co., New Delhi.
6. **A.B. Bhattacharya,** *Electronics Principles and Applications*, New Central Book Agency P.Ltd., Kolkata, 2007.

REFERENCE BOOKS

1. **Jacob Millman, Christos C Halkins and Chetan**, *Integrated Electronics Analog and Digital Circuits and Systems*, Parikh, 2nd Edition, Tata McGraw Hill Educatio Private Limited, New Delhi, 2010.
2. **Anil K. Maini and VarshaAgarwal,** *Electronic Devices and Circuits*, Wiley India Pvt. Ltd. New Delhi, 2009.

SEMESTER - I

CORE PAPER – IV

QUANTUM MECHANICS – I

Instructional Hrs. :75 **Sub. Code : 16PHPC104**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective: To introduce the students to the concepts of quantum mechanics.

To make them to prepare for state & national level examinations

Unit -I **15 Hrs.**

General formalism of quantum mechanics

Linear Vector Space- Linear Operator- Eigen Functions and Eigen Values- Hermitian Operator- Postulates of Quantum Mechanics- Simultaneous Measurability of Observables- General Uncertainty Relation- Dirac's Notation- Equations of Motion; Schrodinger, Heisenberg and Dirac representation- *momentum representation*.

Unit -II **15 Hrs.**

Energy Eigen value problems

Particle in a box – *Linear Harmonic oscillator*- Tunnelling through a barrier- particle moving in a spherically symmetric potential- System of two interacting particles-Rigid rotator- Hydrogen atom

Unit -III **15 Hrs.**

Angular Momentum

Orbital Angular Momentum-Spin Angular Momentum-Total Angular Momentum Operators-Commutation Relations of Total Angular Momentum with Components-Ladder operators-Commutation Relation of J_z with J_+ and J_- - Eigen values of J^2, J_z-Matrix representation of J^2, J_z, J_+ and J_- - Addition of angular momenta- Clebsch Gordon Coefficients – Properties.

Unit- IV **15 Hrs.**

Approximate Methods:

Time Independent Perturbation Theory in Non-Degenerate Case -- Degenerate Case-*Stark Effect in Hydrogen atom* – Spin-orbit interaction - Variation Method – Born-Oppenheimer approximation -- WKB Approximation.

Unit- V **15 Hrs.**

Many Electron Atoms

Indistinguishable particles – *Pauli principle*- Inclusion of spin – spin functions for two-electrons- The Helium Atom – Central Field Approximation - Thomas-Fermi model of the Atom - Hartree Equation- Hartree -Fock equation.

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **P.M. Mathews & K. Venkatesan**, *A Text Book of Quantum Mechanics*, Tata McGraw Hill 2010.
2. **G. Aruldhas**, *Quantum Mechanics*, Prentice Hall of India 2006
3. **David J.Griffiths,** *Introduction to Quantum Mechanics*, Pearson Prentice Hall 2005

REFERENCE BOOKS

1. **L.I Schiff,** *Quantum Mechanics* McGraw Hill 1968
2. **A. Devanathan**, *Quantum Mechanics*, Narosa Publishing-New Delhi
3. **R.Shankar,** *Principles of Quantum Mechanics*, Springer 2005

SEMESTER - II

CORE PAPER – V

MATHEMATICAL PHYSICS – II

Instructional Hrs. : 90 **Sub. Code : 16PHPC205**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : Mathematics is aptly called the language of physics. The paper provides the core concepts of mathematical physics. The syllabus is so framed that it fulfills the requirements of CSIR / GATE / NET Exams.

Unit -I **18 Hrs.**

Probability

Probability-Addition rule of Probability - Multiplication Law of Probability- Probability distribution-Binomial distribution - mean Binomial distribution - Standard deviation of binomial distribution -Poisson distribution - Normal distribution - characteristics of normal distribution - Applications of normal distribution.

Unit- II **18 Hrs.**

Complex variables

Complex Algebra- Cauchy-Riemann Conditions-Cauchy's Integral Theorem- Cauchy's Integral formula-Laurent expansion-singularities-*Mapping*- Conformal mapping-Calculus of residues.

Unit – III **18 Hrs.**

Group Theory

Definition of Group - Subgroup, invariant group, *abelian group*, orthogonal and unitary groups -Homomorphism, isomorphism - Reducible and irreducible representations - Generators of Continuous groups.

Unit – IV **18 Hrs.**

Linear vector spaces

Definition and Examples-Real Linear vector space-Uniqueness of Null and Reversed vectors-*Scalar Products of Vectors*- : Definition of Scalar Product of two vectors, Scalar product for real linear vector spaces, Cauchy-Schwartz inequality-Metric Spaces-Linear Independence of vectors and basis for a vector space-Dimension of a vector space-Orthonormal basis-Vector Subspaces-Direct sum decomposition.

Unit – V **18 Hrs.**

Tensor Analysis

Definition of Tensors – *Contravariant, covariant and mixed tensors* – addition and subtraction of Tensors – Summation convention- Symmetry and Anisymmmetry Tensor – Contraction and direct product – Quotient rule- Pseudotensors, Levi-Civita Symbol - Dual tensors, irreducible tensors-Metric Tensors-Christoffel symbols – Geodesics.

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **Arfken & Weber,** *Mathematical Methods for Physicists*, Elsevier 6th edition 2010.
2. **Parthasarathy H**, *Topics in Mathematical Physics*, Ane Books Pvt. Ltd 2007
3. **S.D. Joglekar,** *Mathematical Physics*, Universities Press Pvt.Ltd. 1st Edition 2005
4. **H.K. Dass and R. Verma**, *Mathematical Physics*, S. Chand & Company 2nd Ed. 2001

REFERENCE BOOKS

1. **Erwin Kreyszig**, *Advanced Engineering mathematics*, Wiley Eastern 7th Edition 1993
2. **B.D. Gupta**, *Mathematical Physics*, Vikas Publishing House Pvt.Ltd 3rd Edition 2006

SEMESTER - II

CORE PAPER – VI

ADVANCED COMPUTATIONAL PHYSICS

Instructional Hrs. : 90 **Sub. Code : 16PHPC206**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : The syllabus provides a base for students in high performance computation and visualization software

UNIT – I

Roots of equation **18 Hrs.**

Bisection method – False position method – Newton Raphson method – Basic Gauss elimination method – Gauss elimination with partial pivoting – Gauss Jacobi iteration method – Gauss Seidal iteration method – Inversion of a matrix using Gauss elimination method – LU decomposition.

UNIT – II **18 Hrs.**

Eigen values and Interpolation

Power method to find dominant eigen value - Inverse power method to find all eigen values – Jacobi method – (only 2x2 and 3x3 matrices) Forward and Backward differences – Gregory Newton forward and backward interpolation formula for equal intervals – Divided difference – *properties of divided differences* – Newton's divided differences formula – Lagrange's interpolation formula for unequal intervals.

UNIT – III **18 Hrs.**

Numerical integration and differences

Method of least squares – straight line, parabola , $y = ax^n$, $y = ae^{bx}$, $y = a+bx^n$ type curves – sum of squares of residuals for straight line and parabola fit – Newton's forward and backward differences formula to get the derivatives (First and Second order) - Divided differences table to calculate derivatives for unequal intervals Newton – cotes formula – (Trapezoidal rule, Simpson's rule, Simpson's 3/8 rule, Boole's rule) – *Error estimates in trapezoidal and Simpson's rule.*

UNIT – IV **18 Hrs.**

Differential Equation

Basic Euler method – Improved Euler method – *Modified Euler method* – Runge Kulta fourth order method – RK4 method for simultaneous first order differential equation RK4 Method for second order differential equation – partial differential equation – Difference – quotients – Graphical representations of partial quotients – Classification of partial differential equation of the second order – standard and diagonal five point formula for laplace equations – solution of laplace's equation (Liebmann's iterations process).

UNIT – V

Matlab Fundamentals **18 Hrs.**

Introduction – Matlab Features – Desktop Windows: Command History, Workspace, Array Editor and Current Directory – *Matlab Help and Demos* – Matlab Functions, characters, operators and commands. Basic arithmetic in Matlab – Basic Operations with Scalars, Vectors and Arrays – Matrices and matrix Operations – Complex Numbers – Matlab Built in Functions – Illustrative examples Control flow statements**:** if, else, else if, switch Statements – For, while loop structures – break Statement- Input-Output Commands – Function m files – Script m files – Controlling Output.

Programming

Charging of a capacitor in an RC circuit with three times constant –Plotting input and output characteristics of an NPN transistor

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **K. Venkataraman**, *Numerical methods in science and engineering*, National publishing company, Madras – 1996.
2. **P. Kandasamy, K. Thilgavathy, K. Gunavathy**, *Numerical methods*, S. Chand & Company Ltd., New Delhi, 2007.
3. **E. Balagurusamy**, *Numerical methods*, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2006.
4. **Rudra Pratap,** *Getting Started with Matlab*, Oxford University Press, New Delhi, 2005.

REFERNCE BOOKS

1. **John H. Mathews**, *Numerical methods for mathematics science and Engineering*, Prentice Hall of India Pvt. Ltd., New Delhi 2000.
2. **T.Veerarajan and T. Ramachandran**, *Numerical methods*, Tata McGraw Hill, New Delhi, 2008.
3. **Brain Hunt, Ronald lipsman, Jonathan Rosenberg,** *A Guide to Matlab for Beginners & Experienced Users*, Cambridge University Press, 2006.

SEMESTER - II

CORE PAPER - VII

QUANTUM MECHANICS – II

Instructional Hrs. :90 **Sub. Code : 16PHPC207**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective: To introduce the students to the concepts of quantum mechanics.

To make them to prepare for state & national level examinations

Unit –I **18 Hrs.**

Time Dependent Perturbation Theory

Time Dependent Perturbation Theory-First and Second Order Transitions-Transition to Continuum of States-*Fermi Golden Rule*-Constant and Harmonic Perturbation-Collision-Adiabatic and Sudden Approximation- A Charged Particle in an Electromagnetic Field.

Unit -II **18 Hrs.**

Scattering Theory

Scattering Amplitude - Expression in terms of Green's Function - Born Approximation and Its validity- Partial wave analysis - *Phase Shifts* – Asymptotic behaviour of Partial Waves-The Scattering Amplitude in Terms of Phase Shift- Scattering by Coulomb Potential and Yukawa Potential.

Unit- III **18 Hrs.**

Theory of Radiation (Semi Classical Treatment)

Einstein's Coefficients-Spontaneous and Induced Emission of Radiation from Semi Classical Theory-Radiation Field as an Assembly of Oscillators-Interaction with Atoms-Emission and Absorption Rates-*Density Matrix and its Applications*.

Unit –IV **18 Hrs.**

Relativistic Wave Equation

Klein Gordon Equation-Plane Wave Equation-Charge and Current Density-Application to the Study of Hydrogen Like Atom-Dirac Relativistic Equation for a Free Particle-Dirac Matrices -Dirac Equation in Electromagnetic Field - *Negative Energy States.*

Unit- V **18 Hrs.**

Quantum Field Theory

Quantization of Wave Fields- Classical Lagrangian Equation-Classical Hamiltonian Equation - Field Quantization of the Non-Relativistic Schrodinger Equation-Creation, Destruction and Number Operators-*Anti Commutation Relations*-Quantization of Electromagnetic Field Energy and Momentum.

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **P.M. Mathews & K. Venkatesan,** *Text Book of Quantum Mechanics*, Tata McGraw Hill 2010
2. **G Aruldhas**, *Quantum Mechanics,* Prentice Hall of India 2006
3. **David J.Griffiths**, *Introduction to Quantum Mechanics,* Pearson Prentice Hall, 2005
4. **A Devanathan**, *Quantum Mechanics,* Narosa Publishing-New Delhi

REFERENCE BOOKS

1. **L.I Schiff**, *Quantum Mechanics*, McGraw Hill 1968
2. **A.K. Ghatak and S. Loganathan**, *Quantum Mechanics*, McMillan India
3. **R.Shankar**, *Principles of Quantum Mechanics,* Springer 2005
4. **Satya Prakash- Kathar Nath Ramnath**, *Quantum Mechanics,* Meerut

SEMESTER - II

CORE PRACTICAL – I

GENERAL EXPERIMENTS

Instructional Hrs: 113 **Sub. Code: 16PHPCP01**

Max. Marks: CIA -40; ESE -60 **Credits: 4**

Any Fifteen Experiments

1. Young's modulus- elliptical fringes (Cornu's method)
2. Young's modulus-hyperbolic fringes (Cornu's method)
3. Stefan's constant.
4. Thickness of wire by air wedge and diffraction.
5. Thermal conductivity – Forbe's method.
6. Electronic charge 'e' by Millikan's oil drop method.
7. Electronic specific charge 'e/m' by Thomson's method.
8. Thermistor – temperature coefficient and band gap energy distribution.
9. Specific heat of a liquid-Ferguson's method.
10. Biprism on optical bench-determination of wavelength.
11. Determination of Viscosity of Liquid.
12. Diffraction at a prism face-determination of wavelength.
13. Photo Electric Cell – Planck 's constant.
14. e/m – Helical Method.

Matlab programming

15. Roots of a quadratic equation, solution of a system of linear equations .
16. Newton-Raphson method and Runge Kutta method .
17. Curve fitting and interpolation.
18. Charging of a capacitor in an RC circuit with three time constants.
19. NPN transistor - Input and Output Characteristics.
20. Frequency response of a low pass filter.

SEMESTER - II

CORE PRACTICAL – II

ELECTRONICS

Instructional Hrs: 112 **Sub. Code: 16PHPCP02**

Max. Marks: CIA -40; ESE -60 **Credits: 4**

Any Fifteen Experiments

1. Regulated and Dual power supply Construction.
2. Parameters of Op-amp.
3. Wave form generators-Op-amp.
4. Wein's bridge oscillator-Op-amp.
5. Phase Shift Oscillator- Op-amp
6. Active filters-Op-amp.
7. Frequency response of an Op-amp
8. Sign, scale changer, adder and subtractor-Op-amp.
9. OP-Amp : Voltage to current and current to voltage converter
10. Analog computer setup for solving simultaneous equations.
11. UJT relaxation oscillator& Schmitt trigger using IC 555.
12. Construction of Half – Adder and Full – Adder circuits using NAND gates.
13. Construction of Half – Subtractor and full – Subtractor circuits using NAND gates.
14. A.C amplifier-inverting, non-inverting, voltage follower-op-amp.
15. Multiplexer and Demultiplexer.
16. Decode and Encoder
17. Construction of amplitude modulation circuit and to calculate the modulation index.
18. Two stage amplifier
19. SCR –Characteristics and its applications
20. Source Follower- FET.

SEMESTER - III

CORE PAPER – VIII

CONDENSED MATTER PHYSICS

Instructional Hrs: 75 **Sub. Code: 16PHPC308**

Max. Marks: CIA -25; ESE -75 **Credits: 4**

Objective: The syllabus is of immense use for students aspiring for research and other competitive Examinations.

Unit -I 15 Hrs.

Crystal Structure and Diffraction

Crystalline state – Basic definitions and crystal systems-elements of Symmetry – Crystal directions –Miller indices – Simple crystal structures(NaCl, CsCl, Hexagonal closed packed structure, Diamond structure, Cubic ZnS structure) – *Bragg's law* – The Laue method- Reciprocal lattice- Brillouin zones –. **Defects and dislocations:** Elementary ideas about crystal defects – Schottkey defect – Frenkel defect – Dislocations – Edge and screw dislocation – Grain boundaries – Dislocations in crystal growth.

Unit -II 15 Hrs.

Lattice Vibrations and Thermal Properties

Vibrations of one dimensional monoatomic linear lattices – Vibrations of one dimensional diatomic linear lattice – Quantization of lattice vibrations – Forbidden frequency band– Phonon momentum – Inelastic scattering of neutrons by phonons – Einstein model of the lattice specific heat of solids – Debye model of lattice heat capacity –Thermal conductivity.

Unit -III 15 Hrs.

Free electron theory, Energy bands and Semiconductor Crystals

Energy levels and density of orbital – Fermi Dirac distribution – Free electron gas in 3-D Heat Capacity of electron gas – Electrical conductivity and Ohm's law – Motion in magnetic fields – Hall effect – Nearly free electron model – *Bloch functions* – Kronig –

Penny model – Semiconductors – Band gap – Effective mass – Intrinsic carrier concentration.

Unit- IV **15 Hrs.**

Dielectrics and Ferroelectrics

Macroscopic electric field – Local electric field at an atom – Dielectric constant and Polarizability – Clausius Mossotti equation – Ferroelectric crystals – Polarization Catastrophe – *Ferroelectric domains*. **Diamagnetism and Para magnetism:** Langevin diamagnetic equation – Quantum theory of Para magnetism – Rare earth ions – Hund's rules – Demagnetization of a paramagnetic salt – Paramagnetic susceptibility of conduction electrons.

Unit -V **15 Hrs.**

Ferromagnetism and Anti ferromagnetism

Ferromagnetic order – Curie point and the exchange integral – Temperature dependence of saturation magnetization – Magnons – Thermal excitation – Ferromagnetic order – *Anti ferromagnetic order* – Anti ferromagnetic magnons – Ferromagnetic domains – Origin of domains – Coercive force and hysteresis. **Superconductivity:** Occurrence of superconductivity – Meissner effect – Thermodynamics of superconductivity transition – London equation – Coherence length – BCS theory – Flux quantization – Type I and Type II superconductors – Josephson superconductor tunneling – DC and AC Josephson effect.

Note : *Italics* denotes Self Study Topics

TEXT BOOKS

1. **Gupta and Kumar,** *Solid State Physics*, Pragathi Prakashan, Meerut, 2005. (Unit I, II and III) .
2. **Kittel. C,** *Introduction to Solid State Physics*, 5th Edition, Wiley Eastern, New Delhi, 1977. (Unit IV and V).
3. **Dekkar. A.J.,** *Solid State Physics*, Mac. Millan, Madras, 1971.

REFERENCE BOOKS

1. **A.M.Wahab.,** *Solid State Physics: Structure and properties of materials*, 2nd Edition, Narosa Publishing House, New Delhi, 2007.

2. **Blackmore.J.S.,** *Solid State Physics*,2nd Edition, Cambridge University Press, Cambridge London, 1974.
3. **Gupta.H.C.,** *Solid State Physics*, Vikas Publishing House, 1995.
4. **Woolfson.M.N.,** *An introduction to X- Ray crystallography*, Vikas Publishing limited, 1978.
5. **Saxena.B.S., Gupta.R.C. and Saxena.P.N.,** *Solid State Physics*, Pragati Prakasham Meerut, 2005.

SEMESTER - III

CORE PAPER – IX

ELECTROMAGNETIC FIELDS AND WAVES

Instructional Hrs. :90 **Sub. Code : 16PHPC309**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : To introduce the students to the basic concepts of Electromagnetic theory .To make them prepare for state & national level physics examinations.

Unit- I **18 Hrs.**

Electrostatics

Columb's law – surface, line and volume charge distributions - Gauss' Law and its applications; Electrostatic potential - Laplace and Poisson equations – Potential of a localised charged distributions – Laplace equation in one, two and three dimensions – Boundary conditions and Uniqueness theorems.

Unit- II **18 Hrs.**

Magnetostatics

Lorentz force law- Biot-Savart law – condition for steady electric current - Ampere's law – *Application of Ampere's law* – Ampere's circuital Law - Magnetic vector and Scalar potential – Magneto static boundary conditions- comparison of Magnetostatics and Electrostatics

Unit –III **18 Hrs.**

Electrodynamics

Electromotive force – *ohms law* – Faradays law – Induced electric field – Energy in magnetic fields – Maxwell's equation in free space – Magnetic charge - Maxwells equation in matter – Boundary conditions - Conservation laws – Conservation of energy – Poynting's theorem - conservation of momentum .

Unit –IV **18 Hrs.**

Electromagnetic waves & interaction with matter

Electromagnetic waves in vacuum – Energy and momentum of EMW – EMW in matter – Propagation in linear media – Reflection and transmission at Normal incidence – Reflection and Transmission at Oblique incidence – Implications: Laws of incidence and reflectance, snell's law, *Brewster law* – Freshnel's equations.

UNIT V **18 Hrs.**

Relativistic electrodynamics: *Four vectors* – Transformation relation for charge and current densities – for electromagnetic potentials –Covariant from of inhomogeneous wave equations - Field equations in terms of four vectors – Transformation selection for field vector E and B covariant form of Lorenz force law.

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **Griffiths. D.**, *Introduction to Electrodynamics* , Percentice Hall of India , 1984.
2**. Richard Feyman,** *Lectures*, Vol. 2,
3. **Jackson** ,*Classical electrodynamics*, Wiley & sons, New York ,2004.
4. **Sathya Prakash**, *Electromagnetic theory and Electrodynamics*, K.N.Ram Nath & Co, Meerut, 2006.
5. **Chopra&Agarwal,** *Electromagnetic theory*, Nath & co, Meerut 2004,

REFERENCE BOOKS

1. **Jordon & Balenar, Prentice,** *EMW radiating systems*, Percentice Hall of India, New Delhi, 2004.
2. **Julius Adams Stratton,** *Electromagnetic theory*, IEEE Press, Piscataway, 2007.
3**. J.D. Jackson**, *Classical Electrodynamics*
4**. Hans Ohanian,** *Classical Electrodynamics*, (ISBN-13:9780977858279) (ISBN-10:0977858278)

SEMESTER – IV

CORE PAPER – X

NUCLEAR AND PARTICLE PHYSICS

Instructional Hrs. :90 **Sub. Code : 16PHPC410**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : To introduce the students to the basic concepts of Nuclear Physics. To make them prepare for state & national level physics examinations.

Unit –I **18 Hrs.**

Nuclear force and Binding

Properties of Nuclear Force – Ground state properties of Deuteron – Square well solution of Deuteron – Low energy, neutron proton scattering - Limits of energy for the scattering of different partial waves - Binding energy - Weizacker's semi empirical mass formula – Application of semi empirical formula for alpha decay – mass parabola for stability of nuclei against beta decay - Evidence of shell effects – Single particle energy levels for infinite square well, harmonic oscillator with spin orbit potential – Application of shell model for spin and parity

Unit –II **18 Hrs.**

Radioactive disintegration

Properties of radioactive rays – Law of radioactivity – Half life and mean life- Radioactive equilibrium - Radioactive series - Range of alpha particles – Alpha spectrum and Fine structure - Alpha-Particle Disintegration Energy- Gamow's theory of Alpha decay – Energetics of Beta decay - Beta-Ray Spectra- Pauli's neutrino hypothesis – Properties of neutrino - Gamma emission – Selection rules – internal conversion - Fission process on the basis of liquid drop model - Nuclear fission energetics - Stability limits against spontaneous fission – Potential for fission - Bohr-Wheeler model

Unit –III **18 Hrs.**

Nuclear reactions

Types of nuclear reaction – Conservation laws in nuclear reactions – Balance of Mass and Energy in nuclear reactions – The Q equation and its solution – Proton, deuteron, neutron and alpha induced reactions – Cross section of nuclear reactions - Separation of

center of mass motion in two body problem – Partial wave method for scattering and reaction cross section – Compound nucleus hypothesis – Breit Wigner one level formula

Unit –IV **18 Hrs.**

Neutron Physics and detectors

Properties of neutron – Classification of neutrons according to energy – Sources of neutron – Neutron detectors – Neutron multiplication and fission chain reaction – Four factor formula – Reactor materials – Geiger Muller counter –Semi conductor detectors (Diffused junction detector, Surface barrier detector) – Uses of semiconductor detectors – Scintillation detector

Unit- V **18 Hrs.**

Particle Physics

Meson Physics – Yukawa's hypothesis – Properties of Pi mesons - Classification of elementary particles — Particle Interaction types – Feynman diagram for electromagnetic interaction, np interaction, weak decays - Symmetry and Conservation laws – Energy and momentum – Angular momentum – Parity – Baryon number – Lepton number – Isospin – Strangeness and Charm – Quark model – Isospin versus strangeness chart (Super multiplet) of mesons and baryons, three quark triplet, quark anti quark couplings

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **S.N. Ghosal**, *Nuclear Physics*, S. Chand Company Ltd (2010)
2. **D.C. Tayal**, *Nuclear Physics*, Himalaya Publishing House Ltd.,
3. **Pandya and Yadav,** *Elements of Nuclear Physics*, Nath & Co, Meerut, 1983,

REFERENCE BOOKS

1. **S.B. Patel,** *Nuclear Physics an Introduction*, New Age international Publishers, 2009
2. **K.S. Krane,** *Introductory Nuclear Physics*, Wiley India Ltd.,
3. **I. Kaplan**, *Nuclear Physics*s, Narosa Publishing House 2002

SEMESTER – IV

CORE PAPER – XI

MOLECULAR SPECTROSCOPY

Instructional Hrs. :90 **Sub. Code : 16PHPC411**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : To introduce the students to the basic concepts of Spectroscopy .To make them prepare for state & national level physics examinations.

Unit-I 18 Hrs.

Microwave and Raman Spectroscopy

Rotation of molecules and their spectra – diatomic molecules – intensity of line spectra – the effect of isotropic substitution – non-rigid rotator and their spectra – polyatomic molecules (linear and symmetric top molecules) – Classical theory of Raman effect - pure rotational Raman spectra (linear and symmetric top molecules).

Unit-II 18 Hrs.

Infra-red and Raman Spectroscopy

The energy of diatomic molecules – Simple Harmonic Oscillator –the Anharmonic oscillator – the diatomic vibrating rotator – vibration-rotation spectrum of carbon monoxide – breakdown of Born-Oppenheimer approximation – the vibrations of polyatomic molecules – influence of rotation on the spectra of polyatomic molecules (linear and symmetric top molecules) – Raman activity of vibrations – vibrational Raman spectra – vibrations of Spherical top molecules.

Unit-III 18 Hrs.

Electronic Spectroscopy of Atoms

Electronic wave function and atomic quantum numbers – hydrogen spectrum – orbital, spin and total angular momentum - fine structure of hydrogen atom – many electron spectrum: Lithium atom spectrum, angular momentum of many electrons – term symbols – the spectrum of helium and alkaline earths – equivalent and non equivalent electrons – basics of X-ray photoelectron spectroscopy.

Unit-IV **18 Hrs.**

Electronic Spectroscopy of Molecules

Diatomic molecular spectra: Born-Oppenheimer approximation – vibrational spectra and their progressions – Franck-Condon principle – dissociation energy and their products – rotational fine structure of electronic-vibration transition - molecular orbital theory – the spectrum of molecular hydrogen – change of shape on excitation – chemical analysis by electronic spectroscopy – reemission of energy – fundamentals of UV photoelectron spectroscopy.

Unit-V **18 Hrs.**

Spin Resonance Spectroscopy

Spin and magnetic field interaction – Larmor precession – relaxation time – spin-spin relaxation - spin–lattice relaxation - NMR chemical shift - coupling constants – coupling between nuclei – chemical analysis by NMR – NMR for nuclei other than hydrogen - ESR spectroscopy - fine structure in ESR.

Note : *Italics* denotes Self Study Topics

TEXT BOOKS

1. **Aruldhas.G**, *Molecular structure and spectroscopy*, PHI Learning Pvt Ltd, New Delhi,2008.

REFERENCE BOOKS

1. **Gupta., Kumar., Sharma**., *Spectroscopy*, Pragati Prakashan, Meerut, 2006.
2. **Gurdeep R.Chatwal,***Spectroscopy(Atomic and Molcular),*Himalaya Publishing House, New Delhi,2006.
3. **Straughan and S.Walker**., *Spectroscopy,* Vol 1, 2, 3, Chapman & Hall, Chennai, 1976.
4. **Banwell**. **C.N.**, *Spectroscopy,*, III edition, Tata McGraw Hill, New Delhi, 1980.
5. **Barrow**. **G.M.**, *Introduction to molecular spectroscopy* , Tata McGraw Hill, New Delhi, 1962.

SEMESTER-IV

CORE PRACTICAL - III

ADVANCED EXPERIMENTS

Inst.Hrs:120 **Sub.Code: 16PHPCP03**

Max. Marks: CIA-40; ESE-60 **Credits: 4**

Any Ten Experiments

1. Arc Spectra
2. Self inductance and Mutual inductance of the coil - Anderson's Bridge
3. Michelson Interferometer – λ, d λ
4. Susceptibility – Guoy`s method
5. Susceptibility – Quincke's method
6. Deposition of thin film by Dip coating method
7. Compressibility of a liquid – Ultrasonic method
8. Hall Effect
9. e/m – Magnetron Method
10. B – H curve – Anchor ring method
11. B – H curve – Solenoid, Tracer
12. Wavelength and refractive index of liquid – Diode laser
13. Kelvin's Double Bridge – Determination of very low resistance & Temperature coefficient of resistance.
14. Refractive index of liquid- Biprism.
15. Polarizability of liquid-Spectrometer.
16. Thickness of the material using diode laser.
17. Measurement of resistivity and Hall coefficient – Vander Pauw method

SEMESTER-IV

CORE PRACTICAL - IV

SPECIAL ELECTRONICS

Inst.Hrs:120 **Sub.Code:16PHPCP04**

Max.Marks: CIA-40; ESE-60 **Credits: 4**

Any Twelve Experiments

1. OP-Amp : Circuits using diodes – Half wave, full wave, clipper and clamper
2. IC 555 timer application – Monostable and Astable Multivibrator
3. A/D Converters – any one method.
4. D/A Converters – Binary weighted and Ladder methods
5. Modulation Counter
6. 7473 –Up/Down Counter ,Shift Register, Ring Counter and Johnson Counter
7. Instrumentation amplifier
8. Tunnel diode – characteristics
9. Square and Square root of a single byte, two digit BCD number.
10. Code Conversions – (i) Decimal to Hexadecimal (ii) Hexadecimal to Decimal (iii) Hexadecimal to ASCII and (iv) ASCII to Hexadecimal.
11. Largest /Smallest number in an array and Ascending / descending order of N numbers.
12. LED Interfacing.
13. Stepper Motor Interfacing.
14. Traffic control simulation.
15. Hex Key board interfacing.
16. Musical Tone Generator.
17. ADC Interface.
18. DAC Interface.

SEMESTER-III

ELECTIVE PAPER-I

COMMUNICATION ELECTRONICS & MICROPROCESSOR

Instructional Hrs: 75 **Sub Code: 16PHPE301**

Max. Marks: CIA -25; ESE -75 **Credits: 4**

Objective: To provide a comprehensive approach to the students in the design and analysis of communication electronic circuit and an understanding of Microprocessor and its applications.

UNIT I **15 Hrs.**

Antennas & Wave Propagation: Terms and definitions – Effect of Ground on antennas – Directional High frequency Antennas – Wideband and special purpose Antennas – Wave Guides – Rectangular waveguide – Circular and other waveguides – Propagation of Waves – Ground (Surface) Waves – Sky wave Propagation-The Ionosphere – Space Waves – Tropospheric Scatter Propagation – Extraterrestrial Communications.

UNIT II **15 Hrs.**

Communication Electronics: Communication systems – Information – Transmitter Channel-Noise – Receiver. – Pulse Communications System – Information Theory – Pulse Modulation – Pulse System – Digital Communications – Fundamentals of Data Communication Systems – Data Sets and Interconnection Requirements – Network and Control Considerations.

UNIT III **15 Hrs.**

Broad band communication system – Multiplexing –FDM –TDM - Short and Medium Haul Systems – Coaxial cables –Fiber optic links-Microwave links – Tropospheric scatter links -Long Haul Systems – Submarine cables – Satellite communications - Elements of Long Distance Telephony

UNIT IV **15 Hrs.**

Microprocessor – 8085: Architecture of 8085 – *Pin configuration* - Instruction set of 8085- Instruction types - based on number of bytes, based on operation – Simple programs using arithmetic and logical instructions - Interrupts: Maskable and non-maskable, vectored interrupts. Programmable peripheral interface (8255A) - Interfacing data converters.

UNIT V **15 Hrs.**

Microprocessor – 8086: Introduction – Architecture – Instruction classification – Instruction format – Data transfer operation – Arithmetic operations – *Logic operations*-rotate, compare – Writing assembly language programmes – Addition, Subtraction, Multiplication, Division, comparison of two numbers.

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **Kennedy.** *Electronic Communication*, Tata McGraw Hill, New Delhi, 2006.
2. **Taub & Schilling.** *Principle of communication system*, Tata McGraw Hill, New Delhi, 2003.
3. **Goankar.,** *Microprocessor & architecture programming and application with 8085/8080*, New World International (P) Ltd, 1995.
4. **V.Vijayendran.** , *Fundamentals of Microprocessor -8086,* S.Viswanathan (Printers & Publisher), Pvt. Ltd., 2002**.**

REFERENCE BOOKS

1. **Gupta & Kumar.,** *Handbook of Electronics* , Pragati Prakashan, Meerut, 1995.
2. **Roddy and Coolen.,** *Electronic Communication*, Pearson Education, New Delhi, 2004.
3. **Mathur.,** *Introduction to Microprocessor*, Tata McGraw Hill, New Delhi, 1999.
4. **V.Vijayendran.** , *Fundamentals of Microprocessor -8085* ,S.Viswanathan (Printers & Publisher), PVT .LTD, 2002.
5**. Douglas V.Hall**, *Microprocessors and Interfaces*, Tata McGraw Hill Company.

SEMESTER – IV

ELECTIVE PAPER-II

THERMODYNAMICS AND STATISTICAL MECHANICS

Instructional Hrs. :90 **Sub. Code : 16PHPE402**

Max. Marks : CIA -25; ESE -75 **Credits: 4**

Objective : To introduce the students to the basic concepts of Thermodynamics. To make them prepare for state & national level physics examinations.

Unit – I **18 Hrs.**

Thermodynamics, Microstates and Macrostates

Basic postulates of thermodynamics – Fundamental relations and definition of intensive variables – Intensive variables in the entropic formulation – Equations of state – Euler relation, densities - Gibbs-Duhem relation for entropy - Thermodynamic potentials – Maxwell relations – Thermodynamic relations – Microstates and macrostates – Ideal gas – Microstate and macrostate in classical systems – Microstate and macrostate in quantum systems – *Density of states* – Volume occupied by a quantum state

Unit – II **18 Hrs.**

Microcanonical, Canonical and Grandcanonical Ensembles

Microcanonical distribution function – Two level system in microcanonical ensemble – Gibbs paradox and correct formula for entropy – The canonical distribution function – *Contact with thermodynamics* - Partition function and free energy of an ideal gas – Distribution of molecular velocities – Equipartition and Virial theorems – The grand partition function – Relation between grandcanonical and canonical partition functions – One-orbital partition function

Unit – III **18 Hrs.**

Bose-Einstein, Fermi-Dirac and Maxwell-Boltzmann Distributions

Bose-Einstein and Fermi-Dirac distributions – Thermodynamic quantities – Fluctuations in different ensembles – Bose and Fermi distributions in microcanonical ensemble - Maxwell-Boltzmann distribution law for microstates in a classical gas - *Physical interpretation of the classical limit* – Derivation of Boltzmann equation for change of states without and with collisions – Boltzmann equation for quantum statistics – Equilibrium distribution in Boltzmann equation

Unit – IV **18 Hrs.**

Bose Gas and Fermi Gas

Non-interacting Bose gas and thermodynamic relations – Chemical potential of bosons – pressure and energy density of bosons – Black body radiations and Planck's distribution law – Number density of photons and Bose condensation - Thermodynamic relations for non-interacting Fermi gas – *Fermi gas at zero temperature* – Fermi energy and Fermi momentum – Pressure and energy density – Fermi gas at low temperature – Massless Fermi gas at any temperature, Particles and antiparticles

Unit – V **18 Hrs.**

Heat capacities, Ising model and Phase Transitions

Heat capacities of heteronuclear diatomic gas – Heat capacities of homonuclear diatomic gas – Heat capacities of solids; Dulong and petit law, Einstein temperature and Debye theory – Heat capcities of metals – Heat capacitiy of Bose gas – One-dimensional Ising model and its solution by variational method – Exact solution for one-dimensional Ising model - Phase transitions and criterion for phase transitions – Classification of phase transitions by order and by symmetry – *Phase diagrams for pure system*

Note: *Italics* denotes Self Study Topics

TEXT BOOKS

1. **Palash B. Pal,** *An Introductory Course of Statistical Mechanics*, Narosa Publishing House (2008), New Delhi
2. **Kamal Singh & S.P. Singh**, *Elements of Statistical Mechanics*, S. Chand & Company, New Delhi.

REFERENCE BOOKS

1. **Avijit Lahiri**, *Statistical Mechanics An Elementary Outline*, University Press - 2002-Hyderabad

SEMESTER II

SKILL BASED SUBJECT - I

ADVANCED MULTI SKILL PAPER

Instructional Hrs: 45 **Sub Code: 13PHPS201**

Max. Marks: CIA - 40; ESE -60 **Credits: 5**

Aim: To equip the students with knowledge on all topics as desirable from the point of view of brilliant success in the competitive examinations.

Objective: To familiarize the students with various types of tests that are employed by the diverse examining bodies.

UNIT I 9 hrs

Communication: Question tags - Gerund and Infinitives - Spotting the errors-Synonyms – Antonyms - One word substitution – Sentence completion –Prepositions – Articles.
General Awareness and Scientific Aptitude: Socio - Economic - Banking –Basic Sciences People and Environment.
Politics and Current Affairs
Higher Education.
Information and Communication Technology.
Teaching Aptitude.
Research Aptitude.

UNIT II **9hrs**

Logical Reasoning : Syllogism – Statement Conclusions – Statement Arguments – Statement Assumptions – Statement Courses of Action – Inference – Cause and Effect – Visual Reasoning– Direction Sense Test – Blood Relation – Coding and Decoding – Deductive Reasoning.

UNIT III **9hrs**

Numerical Reasoning and Quantitative Aptitude: Age – speed – Heights and Distance –Time and Distance - Ratio and Proportion – Percentage – Fraction – Profit and Loss – Interest –Average – Calendar – Clocks– Probability – Series – Venn Diagram - Data Interpretation.

UNIT IV **9hrs**

Research Methodology: Meaning of research- Objective of research – Motivation in research- Types of research- research approaches- Significance of research- Research

methodsVs methodology- Research and scientific methods- Importance of knowing how research is done- Research process- Criteria of good research- Problem encountered by researches in India.

UNIT V **9hrs**

Manual for preparation of project report: General- Size of the project report- arrangement of contents of project report- page dimension and margin- Manuscript Preparation- Typing instructions- Division of chapters- Numbering instruction.

BOOKS FOR REFERENCE:

1. **Agarwal.R.S,** Quantitative Aptitude, S. Chand and Company, Reprint 2012.

2**. Chopra.J.K,** Bank Probationary Officers' Examination, Unique Publishers, 2010.

3. **Datason. R.P, Manish Arora and Gulati.SW.L,** Clerical Cadre Recruitment in State Bank of India, Newlight Publishers, 2013.

4. **Davinder Kaur Bright,** Railway Recruitment Board, Bright Publications, 2010.

5. **Lal, Jain and Vashishtha**, K.C, UGC NET/JRF/SET Teaching and Research Aptitude, Upkar Prakashan Publishers, 2012.

6. **Pratyogita Darpan**, UGC NET/JRF/SET Teaching and Research Aptitude, Upkar Prakashan Publishers, 2012

7. **Sharma.J.K,** IBPS Recruitment of Bank Clerical Cadre Examination, Unique Publishers, 2013.

8. **Tara Chand**, General Studies for Civil Services Preliminary Examinations,

   Paper– I, Tata Mc Graw Hill Education Private Ltd, 2013.

9. **Hari Mohan Prasad and Uma Rani Sinha**. 2011. Objective English for Competitive Examinations. New Delhi: Tata McGraw Hill Education Private Ltd.

10. **Jain T.S**. Upkar's SBI Clerical Cadre Recruitment Examination. Agra: Upkar Prakashan.

11. **Dr.C.R.Kothari**, Research Methodology: Methods and Techniques, New Age International (P) Ltd, New Delhi.

SEMESTER-III

SKILL BASED SUBJECT-II

NANOSCIENCE AND TECHNOLOGY

Instruction Hrs: 45 **Sub Code: 11PHPS302**
Max Marks: CIA-25; ESE-75 **Credits: 5**

Unit-I **9 Hrs**

Introduction

Nanometer – Nanotechnology – History of nanotechnology – uses – future of nanotechnology – new potential nanotechnology hazards – safety, hazard & public policy issues.

Unit-II **9 Hrs**

Tools and Techniques

Basic idea of nanotechnology – Techniques used in nanotechnology – bottom – up-technique - top down technique – tools used in nanotechnology.

Unit-III **9 Hrs**

Nano Computers

Proposed types of nano computers – nano chip pushes computing limits – DNA computers – A successor to silicon – nano computers – quantum computers – nano computers in a bottle – nano computers on the horizon – smaller than small.

Unit-IV **9 Hrs**

Nanotechnology & textiles

Commercial potential of nanotechnology for textile industry – methods to apply coating onto fabrics – properties imparted by nano treatment – textile developments – nanotechnology revolution – smart materials – wearable solutions using nanotechnology.

Unit-V **9 H rs**

Nano technology, Environment & Energy

New advances made in hydrogen fuel cells – nanohands – motor future – hydrogen fuel cells – fuel cells potential applications in space & nanotechnology.

Books for study:

1. **Manasi Karkare,** Nanotechnology – Fundamentals & Applications – IK International, New Delhi, 2008. (Unit I-V).

Books for Reference:

1. **Charle P.Poole Jrdul Frank J.Owens,** Introduction to Nanotechnology – Wiley India Pvt. Ltd – 2007.

2. **Gugzhong Cao,** Nanostructures and nano materials: Synthesis, properties and applications – (World Scientific publishing).

3. **J.Pradeep**, NANO the Essentials – Understanding Nanoscience and Nanotechnology. Tata Mc Graw – Hill publishing company limited New Delhi.

SEMESTER – III

SKILL BASED SUBJECT – III

LASERS IN CHEMICAL AND BIOLOGICAL SCIENCES

Instruction Hrs: 45 **Sub Code: 11PHPS303**
Max Marks: CIA-25; ESE-75 **Credits: 5**

Unit-I **9 Hrs.**

Lasers in Medicine

Introduction- Laser and its properties- Laser-Tissue interaction and their medical applications-Thermal effects-Photo chemical effects-Laser plasma effect-Advantages of lasers in surgery and medicine.

Unit-II **9 Hrs.**

Laser light scattering as a probe to study

Introduction-organized molecular assemblies- Deduction of micelle size, polydispersity and shape-Experimental setup.

Unit-III **9 Hrs.**

Changes in Tissue on laser Irradiation and implications in clinical practice

Introduction- Biophysical mechanisms-Reflected Energy-Transmitted energy- Absorbed energy-Clinical implications.

Unit-IV **9 Hrs.**

Dynamic laser light scattering in polymer

Introduction- Background theory- Solution properties of polymers- Internal dynamics-experimental results and discussion.

Unit-V **9 Hrs.**

Laser in Crystal growth

Introduction - Lasers and crystal growth- The Proton-transfer Lasers: Introduction – Acid –base chemistry in the excited single state-excited state intermolecular proton transfer lasers –photon transfer Lasers- Photo stability – amplified spontaneous emission.

TEXT BOOKS

1. **S.Chopra, H.M. Chawla,** *Laser in chemical and biological science*
2. **H.Mohindra Chawla,** *Laser light scattering as a probe to study*, Molecular Organization
3. **Himadri B.Bohidar**, *Dynamic laser light scattering in polymer*

BOOKS FOR REFERENCE

1. **Gulzari Lal Bhalla**, *Laser in Crystal growth*.
2. **H.Mohindra Chawla,** *Changes in Tissue on laser Irradiation and implications in clinical practice*

SEMESTER - I

Non Major Elective

ATMOSPHERIC PHYSICS

Instructional Hrs.: 45 **Sub. Code: 11PHPN101**

Max. Marks: CIA -25; ESE -75 **Credits: 5**

Objective : Syllabus framed to create interest in the basics of atmospheric physics for students of other disciplines.

UNIT I 9 Hrs.

Basic Concepts: Evolution of the atmosphere- structure of atmosphere- Energy in the atmosphere – Factors influencing Isolation- Heating and Cooling of the atmosphere- temperature – Evaporation - Condensation – Precipitation – Climatic types of the world – Hydrosphere – *nature of water – Ocean water.*

UNIT II 9 Hrs.

Composition and structure of the Atmosphere: Composition of the atmosphere – Permanent Gases – Minor Gases – Particles in the atmosphere – Structure on the basic of composition – Chemical structure – Ionic structure – *The outer atmosphere.*

UNIT III 9 Hrs.

Insolation and heat budget: Introduction – *Nature of radiation* – Insolation – factors governing insolation - Transfer of insolation through the atmosphere – Terrestrial radiation – Heat budget of the earth – atmospheric system.

UNIT IV 9 Hrs.

Temperature and Pressure: Introduction – Factors controlling temperature distribution – *horizontal ascepts* – Factors controlling pressure – summer and winter pattern of pressure.

UNIT V **9 Hrs.**

Atmospheric aerolation: Factors controlling wind – Driving forces – steering forces-pressure gradiant forces – coriolis force - *General circulation of the atmosphere* – Dispan Experiment – Computer modeling of the atmosphere - Monsoon circulation.

Note : *Italics* denotes Self Study Topics

TEXT BOOKS

1. **Anthes R.A., Panofsky, Cahir H.A., and Rango**, *Atmosphere* ,Columbus,Ohio, 1981, (Unit I and II).
2. **Cole F.W.,** *Introduction to meteorology***,** Wiley., New York, 1980, (Unit IV and V).
3. **Siddhartha K.,** *Atmosphere weather and climate*, Kisalaya Publications Pvt Ltd., New Delhi, 2005, **(** Unit I to V).

REFERENCE BOOKS

1. **Berry, Bollay F.A., and Beers**, *Hand book of Meteorology*, Tata Mc Graw Hill , 1985.
2. **Budyoko,** *The Earths Climate Past & Future***,** Academic Press, 1982.

SELF LEARNING PAPER – I

OCEANOGRAPHY

SubCode: 13PHPSL03 **Credits: 5**

Max. Marks: ESE-100

Unit – I

History of ocean

Introduction – Definition and scope – Importance of classical period – contributions of the Greats – Golden age.

Unit – II

Morphology of the ocean bottom

Hypsographic above : continental shelf – continental slope – origin of shelf – submachine canyons – origin of submachine canyons – Tsunami (or) setsquare waves – the oceanic deeps – Deep see plains.

Unit – III

Bottom Relief of oceans

Atlantic oceans Islands – Marginal seas – The Pacific Ocean – Islands – Ridges and basins – The Indian Ocean – shape of size – Islands – The Artic Ocean – Islands – Marginal teas – source of heat – surface temp of the ocean water.

Unit – IV

Salinity of ocean water

Salinity – Definition – Significance – Sources of oceanic salts – Variation factors – Distribution of salinity: Vertical and horizontal – Density – Factors compiling the density – distribution of density

Unit – V

Man of Marine Resources

Introduction – The oceans the climate – marine energy resources – finishing – distribution of marine life – Agriculture – Marine pollution – Ocean as modifier of Greenhouse effect.

TEXT BOOKS

1. **Lal.D.S.,** *Oceanography,* Sharda pustak Bhawan. 2nd Edition, Allahabad,2003(Unit I- V)
2. **Davis.W.N.,** *Oceanography*: An Introduction to the Marine Environment, John Wiley & Sons, New York, 1970
3. **Kuenen.P.H.Marine,** *Geology*, John Wiley & Sons, New York, 1950

REFERENCE BOOKS

1. **Ingmanson.D.E. and Wallace.W.J.,** *Oceanography: An Introduction,*Wads worth, California, 1995.
2**. Tom Garrosson.,** *Oceanography:An invitation to Marine Science,* Thomson book, Belment, USA, 2007.